BECKMAN
6401
MEMOREX 8-6-79

MODEL 6401

Beckman®

PLEASE NOTE

This is a preliminary manual. The final manual is now being printed and will be supplied as soon as it is available.

ELECTRONIC INSTRUMENTS DIVISION

MODEL 6401
OPERATING INSTRUCTIONS

INTRODUCTION

The Beckman Model 6401 Programmable Counter and Timer measures frequency, period, multiple period, time interval, and frequency ratio through a frequency range of 0 to 136 MHz. The unit provides eight digits of inline numerical readout with automatically positioned decimal point and legend information. Additional features include remote programming of front-panel controls, BCD storage, BCD outputs, and trigger level monitor lamps. The unit is constructed primarily of integrated circuits, all of which are mounted in sockets for ease of troubleshooting and repair.

The counter will accept a wide range of inputs. Three attenuator positions, AC-DC coupling and trigger level adjustments are provided for both input channels. The individual selection of start and stop slope polarity is provided for time interval and period measurements.

MODES OF OPERATION

TEST: Counts the 10 MHz reference for a gate time selected by the TIME BASE switch.

FREQ: Measures the frequency range of 0 to 136 MHz on A channel; 0 to 10 MHz on B channel.

BURST: Measures the frequency of a signal with a random burst of pulses or sine waves. The time base is synchronized with the envelope of the burst function. The frequency of the burst will be measured directly, provided the time base selected is shorter in duration than the burst envelope being measured.

NOTE

The number of pulses in a burst may be measured by selecting a time base longer than the burst envelope. The number displayed +1 count will be the total number of pulses in that envelope.

COUNT/HOLD: This mode allows manual control of the accumulator gate.

TIME INTERVAL: Measures the time interval between occurrence of an event at the A input and a subsequent event at the B input.

PERIOD: Measures the time interval between two consecutive events on a single channel. Both START and STOP Slopes are selectable.

MULT. PER. AVG.: Allows from 10 to 10^8 periods to be averaged with 0.1 μs resolution.

MULT. RATIO: Displays FA/FB x MULT. selected from 1 to 10^8. FA input range is 0 to 136 MHz; FB is 0 to 10 MHz.

REMOTE: With this position selected, a remote program of channel selection, Function, Time Base, Start Slope, Stop Slope, Display Time, and Reset may be selected from a remote station.

NOTE

Any single channel measurement may be made on either input channel. Channel A will be selected for the measurement unless the A ATTENUATOR switch is placed in the B INPUT position, or the B channel is selected in the REMOTE mode.

SPECIFICATIONS

Specifications for the Model 6401 are listed in Table 1.

Table 1. Specifications

Input Characteristics (A & B Channels)	Attenuation Factors:	1	10	100
	Sensitivity (rms)	0.1V	1.0V	10V
	Resistance (dc)	1.0MΩ	1.0MΩ	1.0MΩ
	Trigger Level	±1.0V	±10V	±100V
	dc Overload	150V	500V	500V
	dc Blocking	500V	500V	500V

continued. . .

Table 1. Specifications - continued

Coupling	AC or DC
Input Capacitance	Input resistance shunted by less than 25pf.
Trigger Slopes	Positive or negative for start and stop.
Internal Reference Frequency	10 MHz.
Time Base Stability	Aging Rate: 1 part in 10^8 per 24 hrs. or better. Stability Temperature: 2.5 parts in 10^6 from $0^{\circ}C$ to $50^{\circ}C$. Line Voltage: 1 part in 10^7 for ±10% line voltage change.
Accuracy	a) Frequency: ±1 count ± oscillator stability. b) Single Period: ±1 count ±oscillator stability ± trigger error. c) Multiple Period: ±1 count ± oscillator stability ± $\frac{\text{trigger error}}{\text{periods averaged}}$ For 0.1 V rms sine wave with a signal-to-noise ratio ≤40 dB. Trigger error ≤0.3% of one period.
Display	a) Eight in-line digits displayed on numerical glow tubes; display includes automatically-positioned decimal point. KHz and MHz for frequency measurements, and μs, ms, s, and Ks for time interval measurements. b) Storage On: Display remains constant unless input parameter changes (except in Count function). c) Storage Off: Display follows progression of counting.
Display Time	Independent of gate time, continuously variable from 0.1 to 10 sec; MIN position 25 μsec.

continued. . .

Table 1. Specifications - continued

Coded Output	a) Four-line, 1-2-4-8 BCD output at rear panel (Amphenol 40500, 50-pin connector), binary 0 is +0.5 V (or less) to ground; binary 1 is +4 V to ground. b) Data is available from buffer storage in all modes except Count or Follow in which the data is continuously updated. c) Print Command is 0.5 to +4 V step, nominal 10 μsec duration.
Auxiliary Inputs	a) External Reference: accepts external frequencies of 1, 2.5, or 5 MHz as a substitute for internal reference; 1000Ω input resistance. Voltage requirements at each frequency are: 1 MHz - from 0.5 V p-p to 6 V p-p. 2.5 MHz - from 0.5 V p-p to 6 V p-p. 5 MHz - from 0.5 V p-p to 1 V p-p. b) Inhibit: contact closure to ground or 0 V logic level which must occur before end of print command. c) Reset: positive-going signal, 1 μsec minimum pulse width.
Auxiliary Outputs	Oscillator Output: 1 MHz sine wave at 1 V from 1000Ω source. Time Base Output: Logic 1 is 4 V or more, and logic 0 is 0.5 V or less from 300Ω source. (T^2L Output.) Maximum current without damage is ±10 mA. The signal is a 100 ns wide pulse. Gate Marker Output: A negative-going pulse from +15 V to power common synchronized with the start/stop signals. The pulse width is 400ns ±50% at the 50% point. +15 V is from a 2.7KΩ source, and the 0 V is from a saturated transistor to 0.5 V power common. The saturation voltage is 0.5 V or less at 10 mA. The gate marker outputs are suitable for intensity modulation of standard laboratory oscilloscopes.
Power	115 or 230 V (selectable at rear panel), 50 to 60 Hz, 63 Watts maximum.

continued. . .

Table 1. Specifications - continued

Temperature	Operating: 0 to +55°C. Storage: -55°C to +75°C.
Weight	20 pounds.
Dimensions	3.5 in high; 17 in. wide; 18.5 in. deep.

DIGITAL RECORDER CONNECTOR

Pin numbers for the Model 6401 are listed in Table 2.

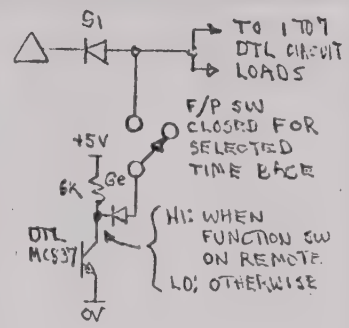
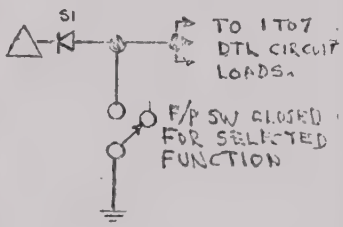
Table 2. Pin Numbers

Pin No.	Decimal Digit	Binary Weight	Pin No.	Decimal Digit	Binary Weight	
1	1	1	26	5	4	
2	1	2	27	5	8	
3	1	4	28	6	1	
4	1	8	29	6	2	
5	2	1	30	6	4	
6	2	2	31	6	8	
7	2	4	32	7	1	
8	2	8	33	7	2	
9	3	1	34	7	4	
10	3	2	35	7	8	
11	3	4	36	8	1	
12	3	8	37	8	2	
13	4	1	38	8	4	
14	4	2	39	8	8	
15	4	4	40	9	1	Ninth Digit Option
16	4	8	41	9	2	
17	5	1	42	9	4	
18	5	2	43	9	8	
19	Accessory Command		44			
20	Ground		45	Inhibit		
21			46	Overflow		
22			47			
23			48			
24			49			
25			50			

REMOTE CONNECTOR

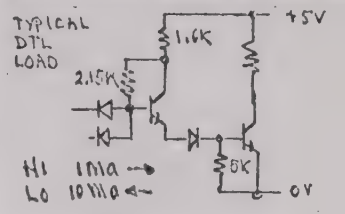
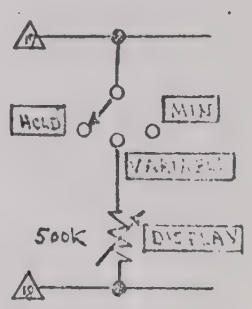
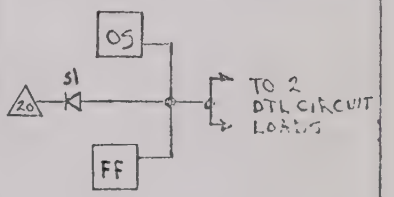
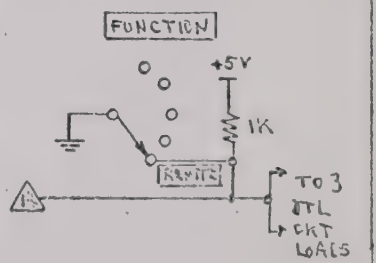
Pin numbers for the remote connector are given in Table 2.

Table 2. Remote Connector Pin Numbers

PIN	FUNCTION	RESPONSE	CIRCUIT
5 6 7 8 9 10 11 12 13	10s 1s .1s 10ms 1ms .1ms 10μs 1μs .1μs] Time Base	HI: No time base selected. LO: Any one input LO will select the respective time base. If more than one input is LO, the fastest time base will occur.	
22 23 24 27 34 35 36 25 26	Test Freq Burst Tim A→B Ratio Per Avg. Period Count Hold] Function	HI: No function selected. LO: Any one input low will select the respective function. More than one input LO will result in an indeterminate function. HI: Counter gate remains in previously selected state. LO: For ≥500 ns will switch the gate to the selected state. Selecting both inputs will place the gate in the hold state.	
31 32	Start Stop] Slope	HI: Negative Slope. LO: Selected slope is positive.	Same as Time Base
33	B Enable	HI: A input is connected to count chain. LO: A input is not used and B input is connected to count chain.	
21	Fast Display	HI: Display time is controlled by front-panel controls of Hold-Variable-Min and Display Time Potentiometers. (Also, see remote display rate Pins 17 and 18.) LO: Display time fixed at 25μs nominal.	

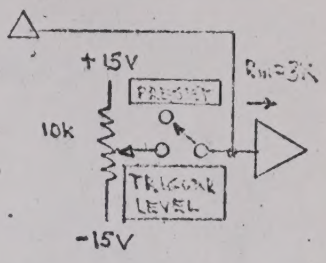
continued.

Table 2. Remote Connector Pin Numbers - continued

PIN	FUNCTION	RESPONSE	CIRCUIT
Notes		A HI input is an open circuit or a voltage level +4 V to +12 V. A LO input is a ground circuit or a voltage level of -0.5 V to +0.5 V.	
17 18	Display Rate	RESISTANCE: When the front-panel HOLD-VARIABLE-MIN switch is placed in the HOLD position, the display time may be controlled externally by placing a 500 KΩ variable resistor across pins 17 and 18. When 500 KΩ, display time is 10 seconds nominal. When 0 Ω, display time is 100 ms nominal. If ext. resistor is applied, it will affect the control range of the front panel control reducing the 100 ms maximum time when not in Remote mode.	
20	Reset	HI: No effect. LO: For ≥1 μs will reset the counter function and data storage. Counter will not be released to take a new count until returned to HI.	
19	Ground	Logic ground. May be used as reference point or source of LO signals, or program return point, if program inhibit is not desired.	
14	Ground, Remote Function	Output: HI when front panel function switch is in any position other than REMOTE. LO when in the REMOTE position. Provides remote program inhibit when not in remote mode.	

continued. . .

Table 2. Remote Connector Pin Numbers - continued

PIN	FUNCTION	RESPONSE	CIRCUIT
15 16	A] Trigger B] Level	Analog: Input points for trigger level voltages. A ±15 V dc voltage will vary the trigger level >±1 V x Attenuator setting on the front-panel control. The front panel trigger level control must be in the preset position otherwise excessive loading will result depending upon the F/P Trigger level pot position.	

DUPLICATE
5 12 68
MAT